CLAIMS

What is claimed is:

1. A roller cone drill bit for drilling an earth formation, comprising:

a bit body;

three roller cones attached to the bit body and able to rotate with respect to the bit body; and

a plurality of cutting elements arranged on each of the roller cones so that cutting elements on adjacent cones intermesh between the adjacent cones, the cutting elements being arranged such that axial force exerted on the bit during drilling is substantially balanced between the cones, wherein the axial force on the cones is determined by selecting bit design parameters, comprising at least a geometry of a cutting element on said bit;

selecting drilling parameters, comprising at least an axial force on said bit;

selecting an earth formation to be represented as drilled;

calculating from said selected drilling parameters, said selected bit design parameters and said earth formation, parameters for a crater formed when one of a plurality of said cutting elements contacts said earth formation;

calculating a bottomhole geometry, wherein said crater is removed from a bottomhole surface;

simulating incrementally rotating said bit, and repeating said calculating of said crater parameters and said bottomhole geometry, based on calculated roller cone rotation speed and geometrical location with respect to rotation of said roller cone drill bit about its axis; and

summing axial force developed by each of said cutting elements in creating said craters.

2. The drill bit according to Claim 1, wherein said cutting elements are disposed on each cone, such that an amount of work performed by each cone during drilling is substantially the same as the amount of work performed by each of the other cones.

3. The drill bit according to Claim 1, wherein a projected area of said cutting elements in contact with a formation during drilling is substantially the same for each of the cones.

4. The drill bit according to Claim 1, wherein a depth of penetration for each cutting element into a formation during drilling is substantially the same for each of the cones.

5. The drill bit according to Claim 1, wherein a distribution of axial force on the bit is optimized.

6. The drill bit according to Claim 1, wherein said cutting elements comprise superhard inserts.

7. The drill bit according to Claim 1, wherein said cutting elements comprise tungsten carbide inserts.

8. The drill bit according to Claim 1, wherein said cutting elements comprise milled steel teeth.

9. The drill bit according to Claim 8, wherein said cutting elements further comprise hardface coating.

10. A roller cone drill bit, comprising:

a bit body;

three roller cones attached to said bit body and able to rotate with respect to said bit body; and

a plurality of cutting elements arranged on each of the cones so that cutting elements on adjacent cones intermesh between the adjacent cones, the cutting elements being arranged such that an amount of work performed by each cone during drilling is substantially the same as the work performed by each of the other cones.

11. The drill bit according to Claim 10, wherein axial force exerted on the bit during drilling is substantially balanced between the cones.

12. The drill bit according to Claim 10, wherein a projected area of said cutting elements in contact with a formation during drilling is substantially the same for each of the cones.

13. The drill bit according to Claim 10, wherein a depth of penetration for each cutting element into a formation during drilling is substantially the same for each of the cones.

14. The drill bit according to Claim 10, wherein a distribution of axial force on the bit is optimized.

15. The drill bit according to Claim 10, wherein said cutting elements comprise superhard inserts.

16. The drill bit according to Claim 10, wherein said cutting elements comprise tungsten carbide inserts.

17. The drill bit according to Claim 10, wherein said cutting elements comprise milled steel teeth.

18. The drill bit according to Claim 17, wherein said cutting elements further comprise hardface coating.

19. A roller cone drill bit, comprising:

a bit body;

three roller cones attached to said bit body and able to rotate with respect to said bit body;

a plurality of cutting elements arranged on each of the cones so that cutting elements on adjacent cones intermesh between the adjacent cones, the cutting elements being arranged such that a distribution of axial force on the bit is optimized.

20. The drill bit according to Claim 19, wherein axial force exerted on the bit during drilling is substantially balanced between the cones.

21. The drill bit according to Claim 19, wherein said cutting elements are disposed on each cone, such that work performed by each cone during drilling is substantially the same as the work performed by each of the other cones.

22. The drill bit according to Claim 19, wherein a projected area of said cutting elements in contact with a formation during drilling is substantially the same for each of the cones.

23. The drill bit according to Claim 19, wherein a depth of penetration for each cutting element into a formation during drilling is substantially the same for each of the cones.

24. The drill bit according to Claim 19, wherein said cutting elements comprise superhard inserts.

25. The drill bit according to Claim 19, wherein said cutting elements comprise tungsten carbide inserts.

26. The drill bit according to Claim 19, wherein said cutting elements comprise milled steel teeth.

27. The drill bit according to Claim 26, wherein said cutting elements further comprise hardface coating.